

DOCUMENT RESUME

ED 153 176

CS 003 983

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TITLE The Degree of Predictability of Four Types of Sentences as Measured by the Eye-Voice Span of Graduate Student Readers.
PUB DATE Dec 77
NOTE 12p.; Paper presented at the Annual Meeting of the National Reading Conference (27th, New Orleans, Louisiana, December 1-3, 1977)
EDRS PRICE MF-\$0.83 HC-\$1.67 Plus Postage.
DESCRIPTORS *Eye Voice Span; Graduate Students; *Models; Oral Reading; *Predictor Variables; Psycholinguistics; Reading Processes; *Reading Research; *Sentence Structure; *Transformations (Language); Visual Perception

ABSTRACT

In a study using eye-voice span (EVS) measures to determine the relationship between the types and numbers of transformations in sentences and the predictability of the sentences for readers, sentences with varying types and numbers of transformations were embedded in paragraphs projected onto a screen and read aloud by the subjects, 20 graduate students. When subjects reached predetermined critical points in the target sentences, the paragraphs were immediately removed from the screen; the number of correct consecutive words that subjects remembered seeing beyond the last word read orally was taken to be the EVS measurement for that paragraph. Analysis of the results indicated that a complex interrelationship exists among the three independent variables--type of sentence transformations, basic sentences versus transformations, and critical point--with regard to the EVS measurement. The results of this study do not coincide with expected results based on the work of previous researchers; rather, they indicate that such previously proposed language processing models as the deep structure model, the chunking model, and the model suggested by Levin and Kaplan offer overly simplistic explanations of language processing. (GW)

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THE DEGREE OF PREDICTABILITY OF FOUR TYPES OF SENTENCES
AS MEASURED BY THE EYE-VOICE SPAN OF GRADUATE STUDENT READERS

Diana Lynn Lagotic

Psycholinguists have attempted recently to explain the strategies involved in the reading process through the use of language processing models. Two major models which have been developed are diametrically opposite in their theoretical positions. The deep structure model, proposed by Mehler (1963) and Miller and McKean (1964), relates reading difficulty to the number and the complexity of the transformation in sentences. The more complex the transformations, the more difficult the reading. A second model, referred to as the chunk model, claims that as a sentence becomes more complex, it becomes easier to read (Pearson, 1974-75, p. 156).

A third model, offered by Levin and Kaplan (Levin, Grossman, Kaplan & Yang, 1972, p. 30), focuses on the extent to which readers use their knowledge of predictability within sentences in attempting to decode and comprehend the sentence. The eye-voice span (EVS), defined as "the distance usually measured in words that the eyes are ahead of the voice," Gibson & Levin, 1975, p. 360, has been used to measure the effects of predictability on the reader.

This study investigated further the processing of language which takes place during reading. Specific sentence structures were used to determine the nature of the regularities and to determine whether there was any relationship between the degree of predictability and the type and number of transformations in each sentence. Since eye-voice span was used as the tool for measurement, information about the amount of material which is picked up and processed by the reader in each sentence was examined.

Method

Sample

The study sample consisted of 20 University of Florida Reading and English graduate students. Any subject who had difficulty reading the sample sentences orally was eliminated. This procedure did not affect the study since the study focused on the way able readers attacked each of the forty sentences.

The Material

Sentences were developed for use in the study. In order to control for vocabulary, words used in the sentences were limited to the Functional Reading Word List for Adults (Mitzel, 1966).

The sentence types developed by the researcher were limited to the following:

1. A basic sentence and its THERE transformation.
2. An active sentence and its passive transformation.
3. A basic sentence and its WH-word transformation.
4. A basic sentence and its IT-inversion transformation with an infinitive subject nominalization.

The sentence types were chosen for the following reasons:

1. The passive transformation and the THERE transformation involve one transformation each. The WH-question transformation involves two transformations, and the IT-inversion transformation with an infinitive subject nominalization involves three transformations.
2. The active and passive sentence types were selected because of the conflicting results of three studies. Levin and Kaplan, in a 1968 study using active and passive sentences, had shown that passive sentences had longer EVS measures than active sentences. Levin and Jones (1968) did not find the same results in one of their two experiments using active and passive sentences. The inclusion of active and passive sentences in this study was done to obtain additional information on this type of transformation.

A critical point (a predetermined place where the EVS was measured) was chosen for each of the sentences. Each basic sentence and its transformed sentence type contained the same number of words to control for the number of words before and after each critical point. One sentence was used for each critical position within each sentence. The following are examples of the positions of the critical points in the basic and transformed sentences:

Each paragraph was projected onto a Caramatt II screen which presents a rear projected image. When a paragraph appeared on the screen, the subject began reading the paragraph orally. When the subject reached a critical point, the paragraph was removed from the screen through the use of a remote control button, and the subject recited as much of the rest of the material as he remembered seeing beyond the last word read orally. The number of correct consecutive words reported was taken to be the EVS measurement for that paragraph. To control for a learning effect, the order of paragraph presentation was randomized independently for each subject. The contrast between the letters and the background was sufficiently low to eliminate any after image when the paragraph was removed. A tape recorder was used to record exact responses.

Results

The statistical treatment used to analyze the data was an analysis of variance on the $4 \times 2 \times 5$ randomized block factorial design. Results indicated significant differences among the sentence types in the degree of predictability $F(12, 741) = 7.38, p < .05$. In order to determine the nature of the significant three-way interaction, tests of the simple interaction effects and simple main effects were done at the .01 level. Tukey tests were conducted to determine where the differences were significant between the means.

The data indicated that a complex interrelationship exists among the three independent variables — types of sentence transformations, basic versus transformation, and critical point — on the EVS measurement.

Discussion and Conclusions

The independent variables — types of sentence transformation, basic versus transformation and critical point — could not be analyzed separately to determine the effect of each on the EVS measurements. The complexity of the interaction of all three independent variables requires that the differences in the EVS measurements be examined, taking all three variables into account.

The deep structure model and the chunking model offer explanations which are too simple according to the findings of this study. The deep structure model proposes that a one-to-one correspondence exists between a grammatical model and a psychological model. In order to add support to this theory, the data should have indicated that as the number of transformations increased, the EVS decreased or the sentence became harder to decode. This did not occur. For example, at critical point five the WH-question transformation, which has two transformations, had a significantly longer EVS measurement than the basic sentence with no transformations.

Basic: Veterans/¹will/²usually/³receive their checks/⁴for partial
5*Significantly longer EVS
disability/⁵within a few days after the first of the month.

WH-Question: When/¹will/²psychologists/³find an answer/⁴for the
5
cause/⁵of severe emotional problems in very young children?

At the other four critical points, there were no significant differences between the basic sentence with no transformations and the WH-question transformation with two transformations.

The chunking model states that as a sentence becomes more complex or has more transformations, it becomes easier to read. This theory was not supported by the data. In fact, the basic sentence with no transformations was significantly easier to decode at critical point four than the IT-inversion transformation, which has three transformations.

Significantly
1 2 3 4*longer EVS
Basic: Exercise/is/difficult/in the beginning/for many
5
individuals/with major health problems from poor
eating habits.

IT-inversion: ¹It/²is/³important/⁴to examine lakes/⁵in remote areas/⁶to identify the needs of the different fish.

The findings indicate that a question about Levin and Kaplan's language processing model needs to be raised. The model states that the EVS will always reflect the grammatical constraints in a sentence by showing a longer EVS where the grammatical constraint is greater. In this study the EVS did reflect the differences in constraint, but not in the direction suggested by the model. Instead of the passive sentence having the longer EVS, the active sentence did. A study by Levin and Jones (1968) also showed the active sentence having the longer EVS measurement. Levin and Kaplan (1968) stated that they could not account for the discrepancies between the studies.

The Levin and Kaplan study (1968) was based on Clark's research (1965) which showed that the latter part of the passive sentence, the verb and the actor, is highly constrained by the first part, the subject. This, according to Clark, was not true of the corresponding parts of

active sentences. Levin and Kaplan's research indicated that the EVS measurements for the active and passive sentences followed the constraints of the two sentences as indicated by Clark. The passive sentence was found to have a longer EVS than the active at the point where the active and the passive forms began to be differentially constrained.

In this researcher's study, at the point where the active sentence, according to Levin and Kaplan, is suppose to have a shorter EVS, the EVS for the active sentence is significantly longer. The critical points for the active and passive sentences were chosen to correspond to the other three types of sentences used in this study; however, a comparison can be made between the active and passive sentences in this study and the Levin and Kaplan study. Examples of the Levin and Kaplan active and passive sentences and the critical points follow:

Active: The brash tall/man/was/certainly/being/loud/at the
meeting of the new group on the main campus.

1 2 3 4 Significantly
5*longer EVS
Passive: The cute chubby/boy/was/slowly/being/
Significantly longer EVS
6*
wheeled/by the maid along the narrow lane to the
country store.

Examples of sentences from this researcher's study follow:

Active: 1 2 3 4*longer EVS 5
The/reckless/cop/was being impulsive/about the message/
near the murder scene from the jealous wife.

Significantly longer EVS
1 2* 3 4
Passive: The/last/survivor/was being examined/by hospital
5
attendants/in a temporary tent near the crash site.

In the Levin and Kaplan sentences, at critical points five and six, the passive sentence had significantly longer EVS measurements than the active sentence. In this researcher's study at critical point four, the active sentence had a significantly longer EVS measurement than the passive. Also, this researcher found that the passive sentence had a significantly longer EVS measurement than the active sentence at critical point two. Levin and Kaplan found significant differences only at points five and six.

One aspect of the language processing model proposed by Levin and Kaplan (Levin, et al., 1972), therefore, is not supported by these findings. According to Levin and Kaplan, the EVS should reflect the differences in constraints of the two sentences. This did occur. However, instead of the passive sentence having the longer EVS, the active sentence did.

Additional research needs to be conducted to investigate the question of whether certain types of sentences are more difficult to read than other types. Results from this study indicated that there were no definite patterns among the sentences. Some sentences with a number of transformations were easier to read than the basic sentence while just the opposite was true of other sentences with a number of transformations. Because no definite patterns could be discerned among the sentences, the concern about whether a child should be presented with a transformed or a non-transformed sentence may not be the

important issue. On the basis of this study, it appears that children need to be exposed to as many sentence types as possible to allow the students to develop versatility in reading.

The major conclusion from this study is that all the models offer explanations of language processing which are too simplistic. The chunk model and the deep structure model focus on the number of transformations in a sentence. Instead of trying to determine whether a transformed sentence is easier or harder to read, the question should be how many factors in addition to transformations affect language processing. Levin and Kaplan's model attempts to examine other variables in addition to the number of transformations in a sentence. The position in the sentence where a measurement is taken is important in the Levin and Kaplan model. The data from this study indicated that the position in the sentence where the EVS measurement was taken had a significant effect on the results, however, the relationship between the EVS and constraint analysis, as proposed by the Levin and Kaplan model, was not supported.

Research which examines the relative merits of the language processing models needs to be continued. The results from this study indicate that language processing is much more complicated than the explanations offered by the major model.

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